

## CLAIMS

1. A magnetic recording medium, comprising:

a substrate,

5 at least one of undercoating layer formed on the substrate, and

a magnetic recording layer which is formed on the undercoating layer and includes a magnetic crystal grains and a grain boundary field which encloses the magnetic crystal grain; wherein

the grain boundary field includes Ti oxide, and the ratio of the substance amount

10 of the Ti oxide in the magnetic recording layer is 5 mol % or more and 15 mol % or less, and the Ti oxide comprises at least  $TiO$  and/or  $Ti_2O_3$ .

2. The magnetic recording medium according to claim 1, wherein the Ti oxide comprises  $TiO_2$ , and the component ratio of the  $TiO_2$  in the Ti oxide is 90 mol % or less.

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3. The magnetic recording medium according to claim 1, wherein the magnetic crystal grain comprises Pt and Cr in addition to Co as a main component; and an orientation of a magnetic easy axis of the grain is perpendicular to the substrate.

20 4. The magnetic recording medium according to claim 1, wherein at least one layer contained in the undercoating layer comprises nonmagnetic crystal grains which contain at least one element selected from the group consisting of Ru, Rh, Pt, and Pd as an main component.

25 5. The magnetic recording medium according to claim 1, wherein the undercoating layer comprises: nonmagnetic crystal grains, which contains at least one element selected from the group consisting of Ru, Rh, Pt, and Pd as an main component; and a grain boundary field, which encloses the nonmagnetic crystal grains and includes an oxide of at least one element selected from the group consisting of Si, Cr, and Ti.

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6. The magnetic recording medium according to claim 1, wherein the ratio of the substance amount of the oxide in the undercoating layer is 1 mol % or more and 15 mol % or less.

5 7. The magnetic recording medium according to claim 1, wherein the oxide contained in the undercoating layer is Ti oxide, and the Ti oxide comprises at least one of TiO and Ti<sub>2</sub>O<sub>3</sub>.

10 8. The magnetic recording medium according to claim 1, wherein the undercoating layer comprises TiO<sub>2</sub> as at least one of the Ti oxide, and the ratio of the TiO<sub>2</sub> in the Ti oxide is 90 mol % or less.

9. A manufacturing method for a magnetic recording medium, comprising the steps of:

15 preparing a substrate on which an undercoating layer is formed; and vapor-depositing a material for magnetic crystal grains and a material comprising at least one of TiO and Ti<sub>2</sub>O<sub>3</sub> to form a magnetic recording layer which includes magnetic crystal grains and a grain boundary field, which encloses the magnetic crystal grains.

20 10. The manufacturing method for a magnetic recording medium according to claim 9, wherein the grain boundary field in the magnetic recording layer includes Ti oxide, and the ratio of the substance amount of the Ti oxide in the magnetic recording layer is 5 mol % or more and 15 mol % or less.

25 11. The manufacturing method for a magnetic recording medium according to claim 9, wherein the Ti oxide in the magnetic recording layer comprises TiO<sub>2</sub>, and the component ratio of the TiO<sub>2</sub> in the Ti oxide is 90 mol % or less.

30 12. The manufacturing method for a magnetic recording medium according to claim 9,

wherein the magnetic crystal grains in the magnetic recording layer comprise Pt and Cr in addition to Co as a main component; and an orientation of a magnetic easy axis of the grain is perpendicular to the substrate.

- 5      13. The manufacturing method for a magnetic recording medium according to claim 9, wherein at least one layer contained in the undercoating layer includes nonmagnetic crystal grains which contain at least one element selected from the group consisting of Ru, Rh, Pt, and Pd as a main component.
- 10     14. The manufacturing method for a magnetic recording medium according to any one of claim 9, wherein at least one layer contained in the undercoating layer comprises: nonmagnetic crystal grains, which contains at least one element selected from the group consisting of Ru, Rh, Pt, and Pd as a main component; and a grain boundary field, which encloses the nonmagnetic crystal grains and includes an oxide of at least one element selected from the group consisting of Si, Cr, and T.
- 15     15. The manufacturing method of a magnetic recording medium according to claim 9, wherein the ratio of the substance amount of the oxide in the undercoating layer is 1 mol % or more and 15 mol % or less.
- 20     16. The manufacturing method of a magnetic recording medium according to claim 9, wherein the oxide contained in the undercoating layer is Ti oxide, and the Ti oxide comprises at least one of TiO and Ti<sub>2</sub>O<sub>3</sub>.
- 25     17. The manufacturing method of a magnetic recording medium according to claim 9, wherein the oxide contained in the undercoating layer comprises TiO<sub>2</sub> as at least one of the Ti oxide, and the ratio of the TiO<sub>2</sub> component in the Ti oxide is 90 mol % or less.
- 30     18. A magnetic read and write apparatus comprising a read and write head and the magnetic recording medium according to claim 1.

19. The magnetic read and write apparatus according to claim 18, wherein the read and write head is a single pole type recording head.